



Enzymes

Topic 2 – chapter 4

What are enzymes?

- Many chemical reactions can be speeded up by substances called **catalysts**.
- Within living organisms, these reactions (metabolic reactions) are controlled by biological catalysts called **enzymes**.
- Enzyme molecules are **proteins**.

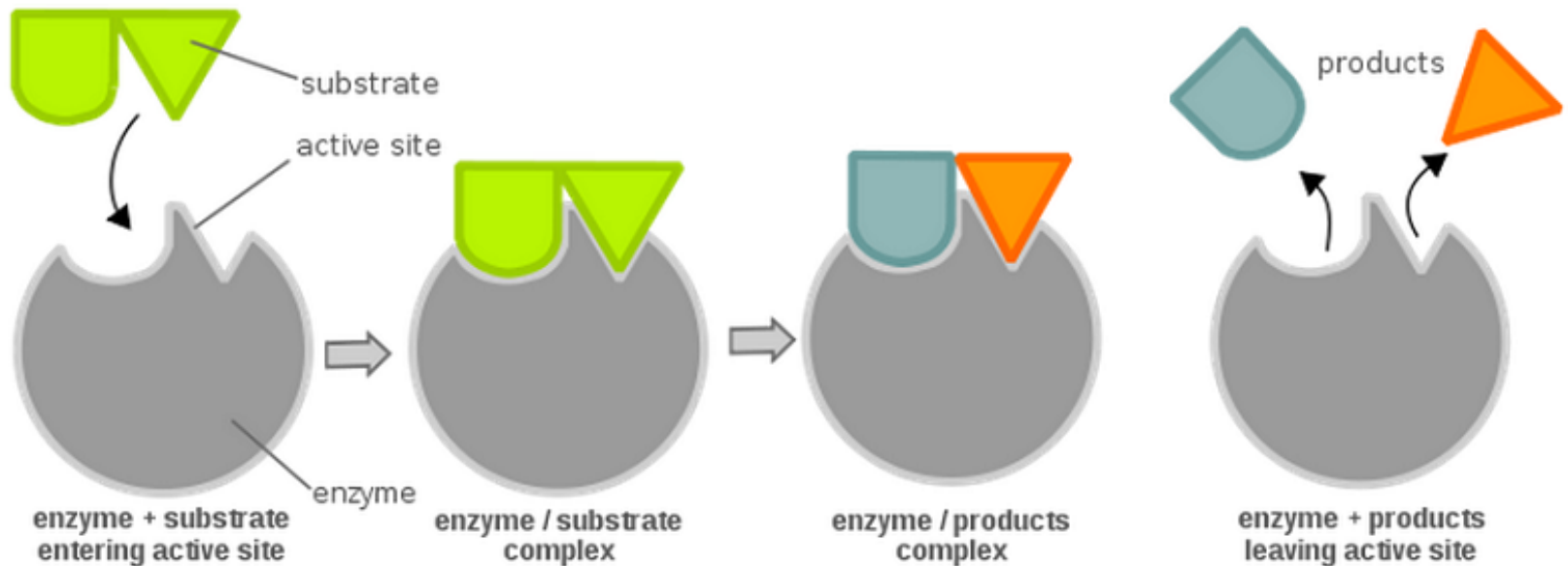
How enzymes work

- Body reactions are slow
- Slow → reduces possibility of survival
- Speed these reactions up by using enzymes
- Many types of enzymes for different reactions
- Most work inside cell but many work outside also

Enzyme reactions

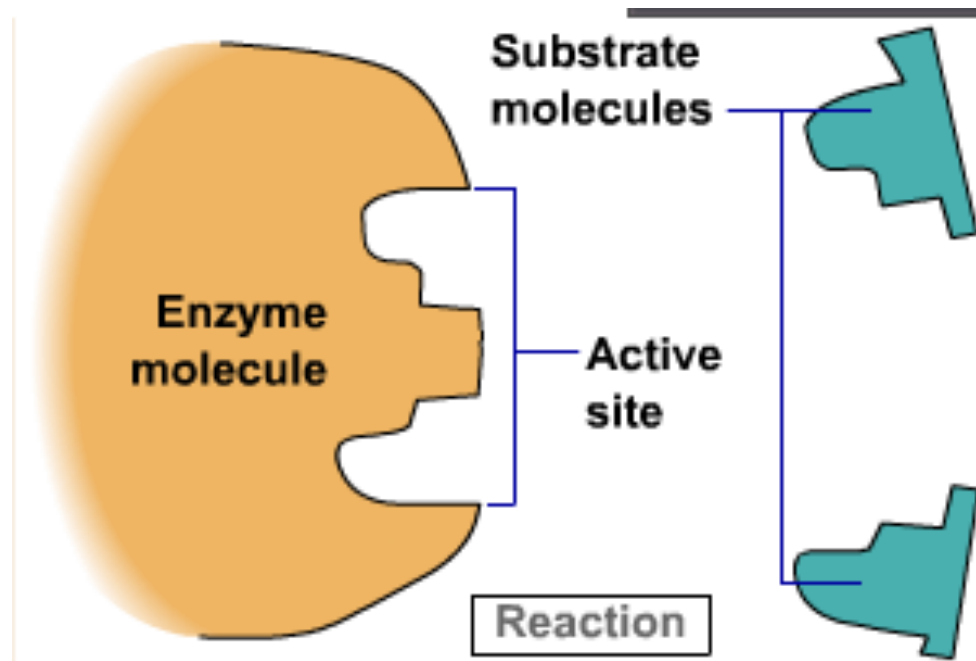
- Reactions that enzyme catalyse:
 - Breaking large molecules into smaller ones
 - Nutrition: smaller molecules absorbed easily
 - bacteria and fungi release enzymes to break food
 - Humans release enzymes to gut for food breaking
 - Building up large molecules from smaller ones
 - To form storage molecules like starch which is made from glucose (small)
 - Plants to form cellulose for cell wall
 - Converting one small molecule into another
 - Changes to molecules by adding or removing atoms. E.g. removing hydrogen from compounds during respiration.

Enzyme reactions



- Substrate: substances enzymes work on
- Active site: part of the enzyme molecule where the substrate binds with the enzymes and the reaction takes place

Enzyme reactions



- Substrate: substances enzymes work on
- Active site: part of the enzyme molecule where the substrate binds with the enzymes and the reaction takes place

Enzyme properties

- All protein
- Each enzyme catalyzes one reaction (Lock and Key)
- Can be reused
- Influenced by temperature and pH

Specific enzymes

- Proteases: speed up digestion of proteins (e.g. pepsin)
- Carbohydrases: speed up digestion of carbohydrates (e.g. amylase)
- Lipase: speed up digestion of lipids

Enzyme activity

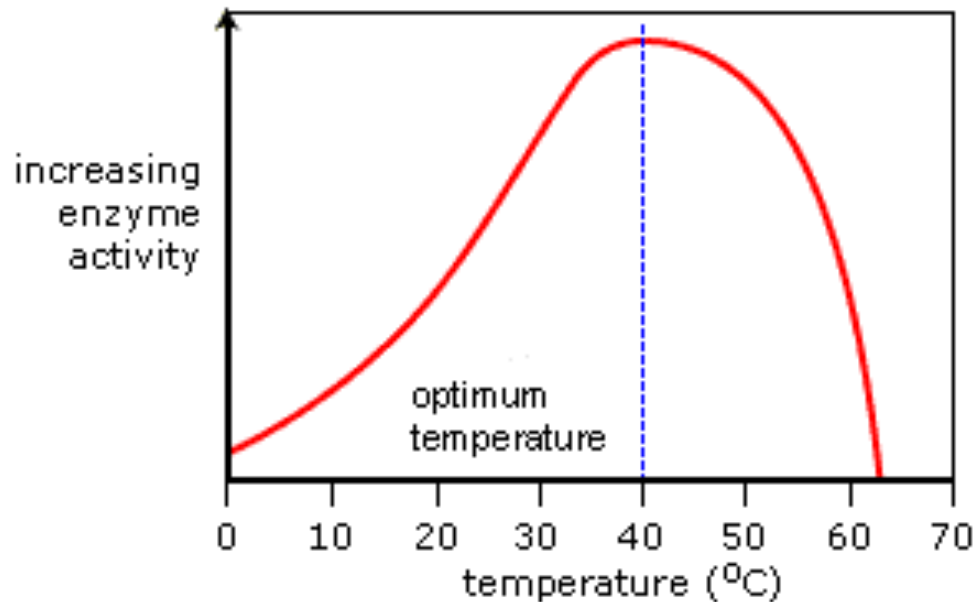
- How can we measure how efficient is the enzyme?

Enzyme activity

- By measuring the rate of the reaction, enzyme activity can be monitored
- We can measure the amount of product formed over time or amount of substrate used over time

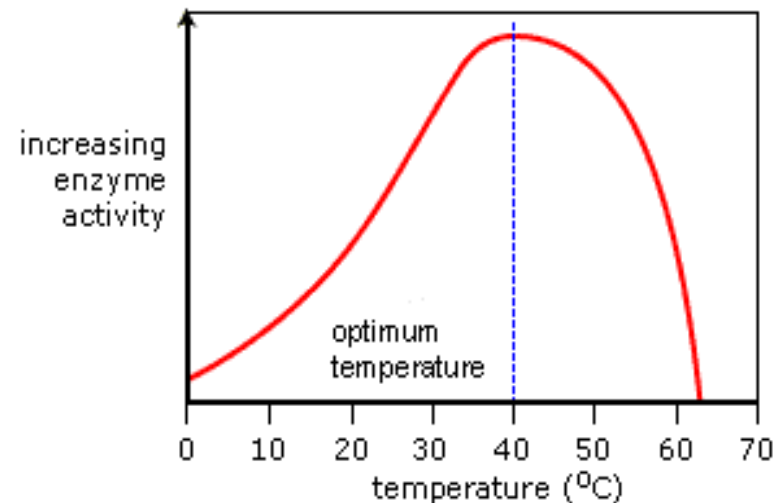
Enzymes and temperature

- What is happening to the rate of enzyme activity in this graph



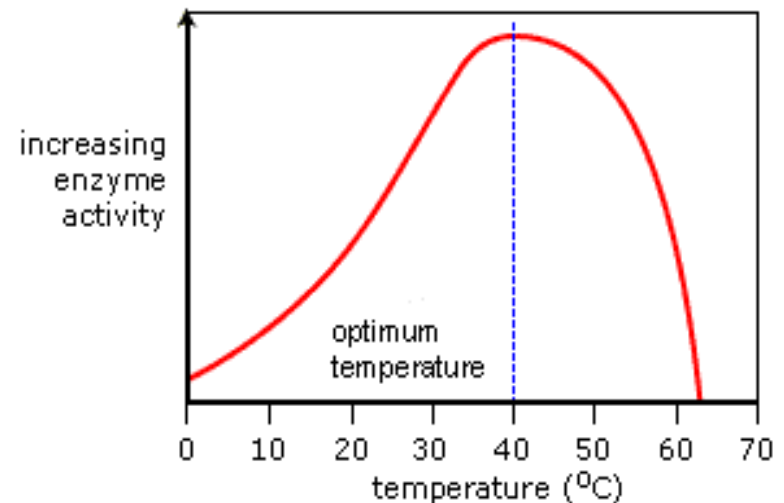
Enzymes and temperature

- Optimum temperature: best temp for enzyme activity
- Higher temperature will lead to more collisions between substrates to form products (they have more kinetic energy)
- At a certain high temperature, bonds holding enzyme break down
- This changes shape of enzyme
- Enzyme can no longer work as active site changed shape
- We say the enzyme has been **denatured**

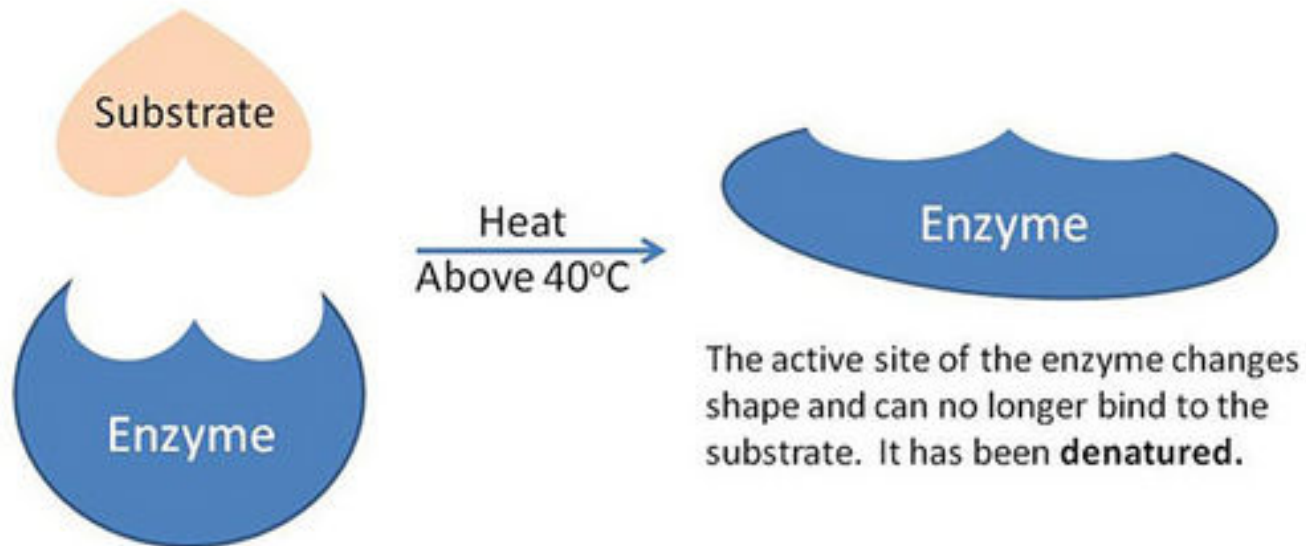


Enzymes and temperature

- Optimum temp examples:
 - Fungal & plant enzymes: approx. 20 °C
 - Human enzymes: 37 °C
 - Enzymes produced by bacteria for use in factories: 90 °C



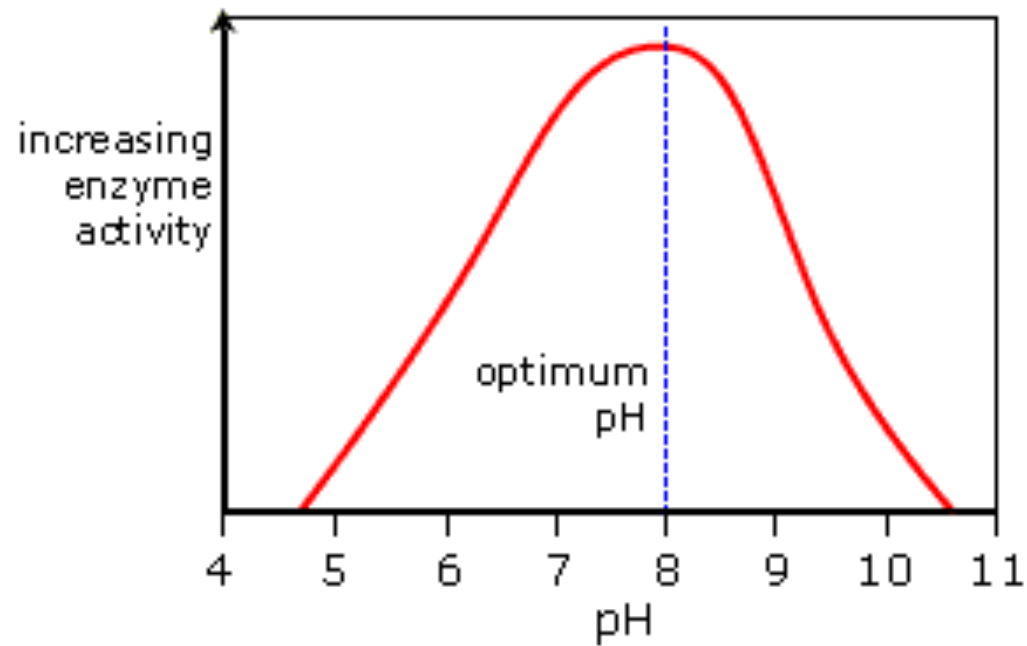
Enzymes and temperature



Enzymes and pH

- Most prefer neutral but some prefer acidic or alkali environment
- Examples: intestinal enzymes have an optimum pH of about 7.5. Enzymes in the stomach have an optimum pH of about 2.

Enzymes and pH



Enzymes and pH

